CHI MEI
OPTOELECTRONICS CORP.

Tentative

TFT LCD Tentative Specification

MODEL NO.: N156B3-L02

Customer : _____

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval

Version 0.0

Tentative

- CONTENTS -

Version 0.0

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 0.0	Nov.14, 2007	All	All	Tentative specification first issued.

Version 0.0

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N156B3-L02 is a 15.6" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1366 x 768 Wide-XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight

- WXGA (1366 x 768 pixels) resolution

- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	344.232(H) × 193.536(V) (15.6" diagonal)	mm	(1)
Bezel Opening Area	347.73 (H) x 197.04 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.252 (H) x 0.252 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	358.8	359.3	359.8	mm	(1)
	Vertical(V)	209	209.5	210	mm	
	Thickness(T)	---	5.9	6.2	mm	
Weight		---	500	515	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	200/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1)   (a) 90 %RH Max. (Ta <= 40 ºC).

         (b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

         (c) No condensation.

Note (2)   The temperature of panel surface should be 0 ºC min. and 50 ºC max.

Relative Humidity (%RH)
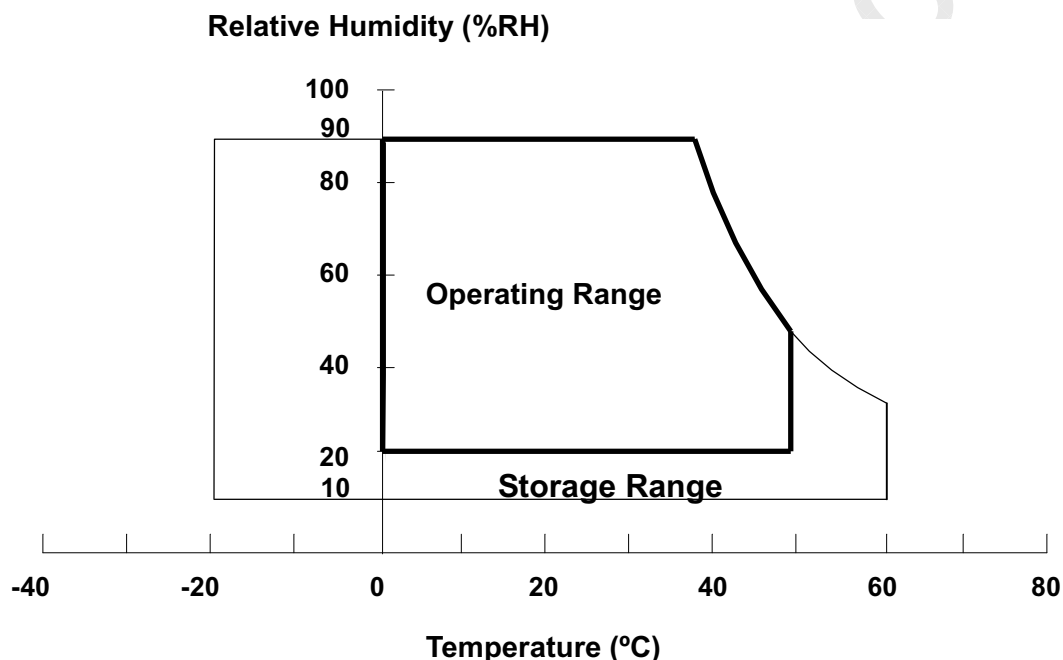
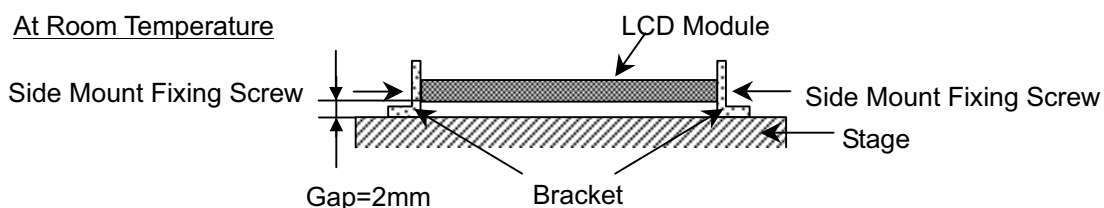Note (3)   1 time for ± X, ± Y, ± Z. for Condition (200G / 2ms) is half Sine Wave,.

Note (4)   10~500 Hz, 0.5hr/cycle 1cycle for X,Y,Z

Note (5)   At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid

         enough so that the module would not be twisted or bent by the fixture.

         The fixing condition is shown as below:

5 / 30

Version 0.0

Tentative

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	Vcc+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = 6.0 mA
Lamp Current	I_L	-	7.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	50	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

Version 0.0

CHI MEI OPTOELECTRONICS CORP.

Tentative

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	-	100	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Initial Stage Current		I_{IS}	-	-	1.0	A	(2)
Power Supply Current	White	-	(320)			mA	(3)a
	Black	-	(380)			mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	-	-	+100	mV	(5), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-100	-	-	mV	(5) V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125	-	1.375	V	(5)
LVDS Differential Input Voltage		$|V_{ID}|$	100	-	600	mV	(5)
Terminating Resistor		R_T	-	100	-	Ohm	-
Power per EBL WG		P_{EBL}	-	TBD	-	W	(4)

Note (1)   The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCC is rising

I_{IS}: the maximum current of the first 100ms after power-on

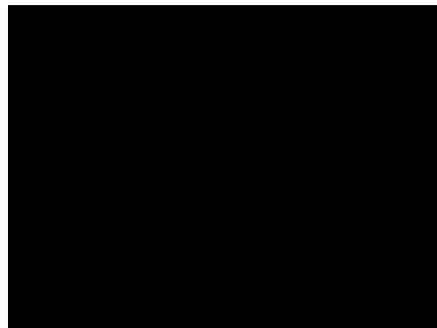Measurement Conditions: Shown as the following figure. Test pattern: black.

Vcc rising time is 470us

7 / 30

Version 0.0
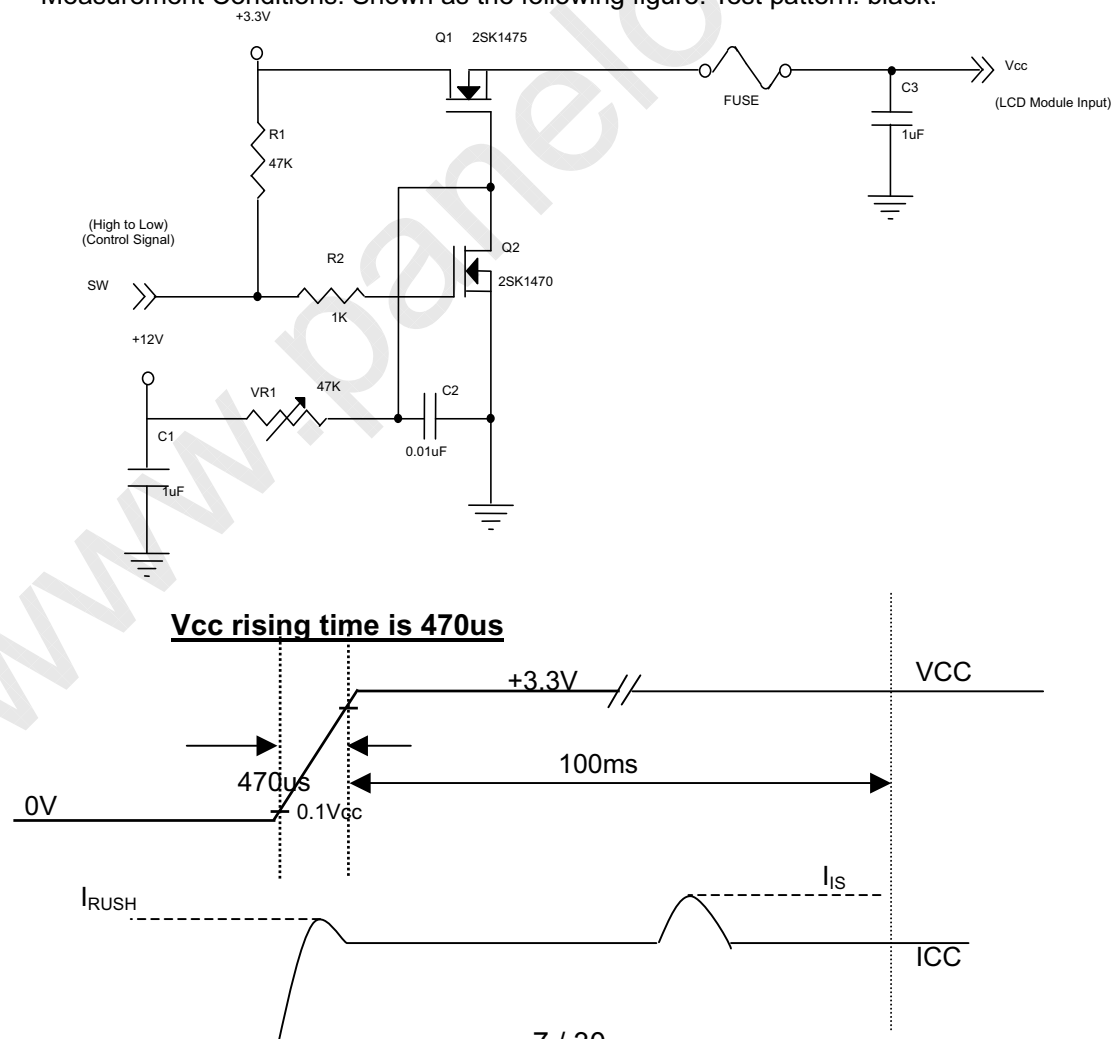
Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, DC

Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern   b. Black Pattern

Active Area   Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input

power. Test conditions are as follows.

(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file

"Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

(c) Luminance: 60 nits.

(d) The inverter used is provided from Sumida.

Note (5)   The parameters of LVDS signals are defined as the following figures.

Single Ended

V_{CM}

0V

$|V_{ID}|$

Differential

$V_{TH(LVDS)}$

0V

$V_{TL(LVDS)}$

$|V_{ID}|$

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative
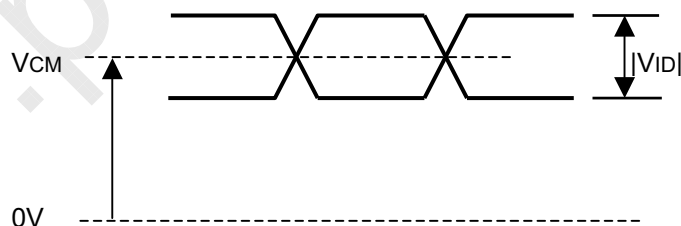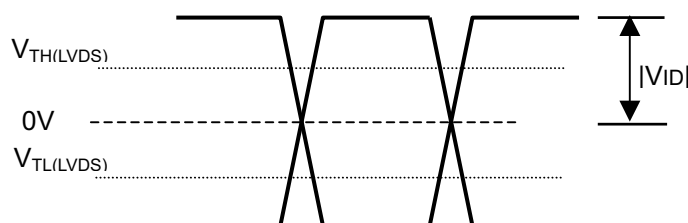
3.2 BACKLIGHT UNIT   Ta = 25 ± 2 ºC

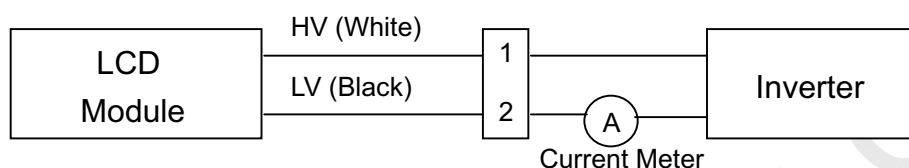| Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	650	750	820	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	2.0	(6.0)	(7.0)	mA_{RMS}	(1),(2)
		3.0				(1),(3)
Lamp Turn On Voltage	V_S	-	-	1460(25 ^{o}C)	V_{RMS}	(4)
		-	-	1600(0 ^{o}C)	V_{RMS}	(4)
Operating Frequency	F_L	50	-	80	KHz	(5)
Lamp Life Time	L_{BL}	15,000	-	-	Hrs	(7)
Power Consumption	P_L	-	4.5	-	W	(6), I_L = 6.0 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:

```
        HV (White)
┌──────────┐  ┌───┐        ┌──────────┐
│   LCD    │──│ 1 │────────│          │
│          │  ├───┤   ┌─┐  │ Inverter │
│  Module  │──│ 2 │───│A│──│          │
└──────────┘  └───┘   └─┘  └──────────┘
        LV (Black)  Current Meter
```

Note (2) for burst mode inverter design

Note (3) for continuous mode inverter design

Note (4) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (5) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (6) $P_L = I_L \times V_L$

Note (7) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 $\pm$2 ^{o}C and I_L = 6.0 mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes $\leqq$ 50% of its original value.

(b) When the effective ignition length becomes $\leqq$ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and

Version 0.0

CHI MEI
OPTOELECTRONICS CORP.

Tentative

symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

c. The ideal sine wave form shall be symmetric in positive and negative polarities.
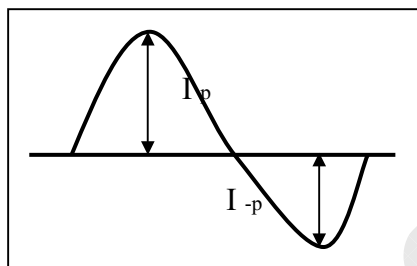
I_p / I_{-p}	* Asymmetry rate: $\| I_p - I_{-p} \| / I_{rms} * 100\%$ * Distortion rate I_p (or I_{-p}) / I_{rms}

Version 0.0

CHI MEI
OPTOELECTRONICS CORP.

Tentative

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

LVDS Display

Data & Clock

Vcc

GND

Data$_{EDID}$

CLK$_{EDID}$

V$_{EDID}$

V$_L$

INPUT CONNECTOR

**LVDS INPUT /
TIMING CONTROLLER**

**DC/DC CONVERTER &
REFERENCE VOLTAGE
GENERATOR**

**EDID
EEPROM**

LAMP CONNECTOR

SCAN DRIVER IC

TFT LCD PANEL

DATA DRIVER IC

BACKLIGHT UNIT

4.2 BACKLIGHT UNIT

1 HV (White)

2 LV (Black)

Version 0.0

Tentative
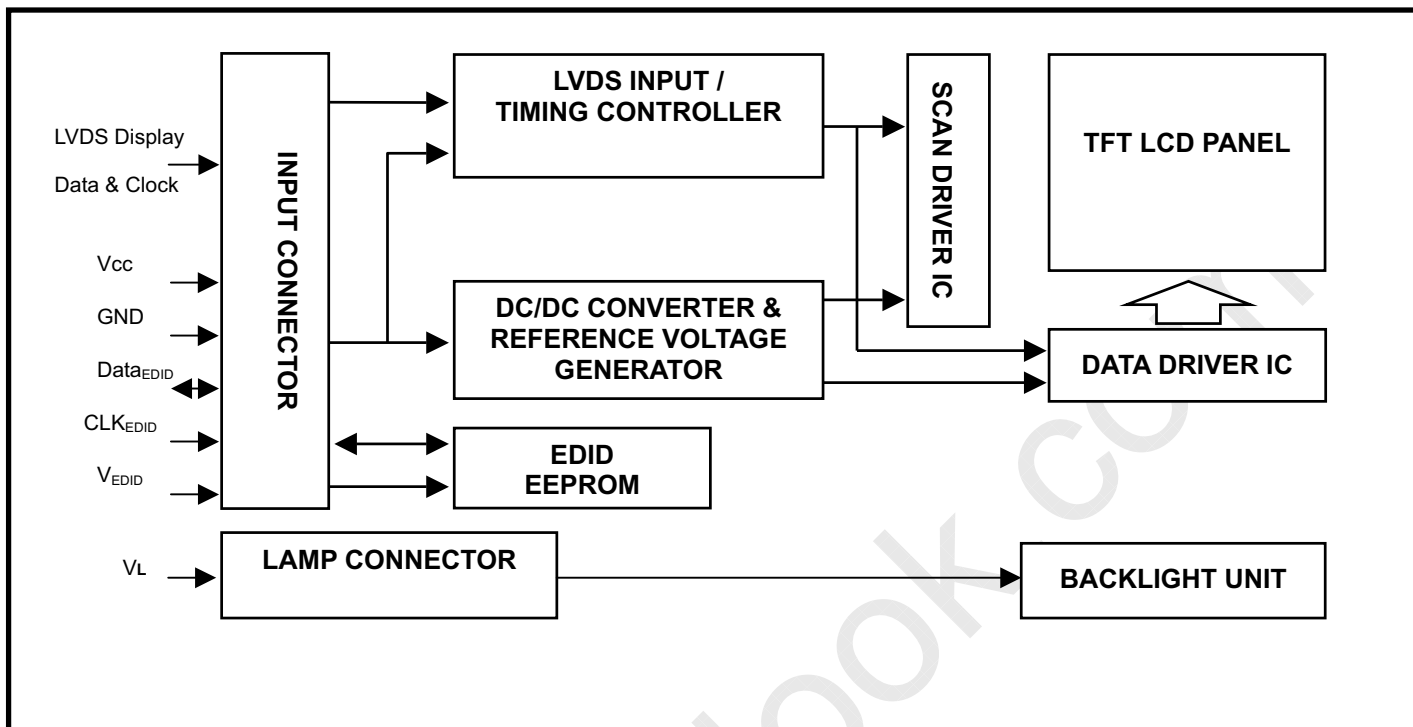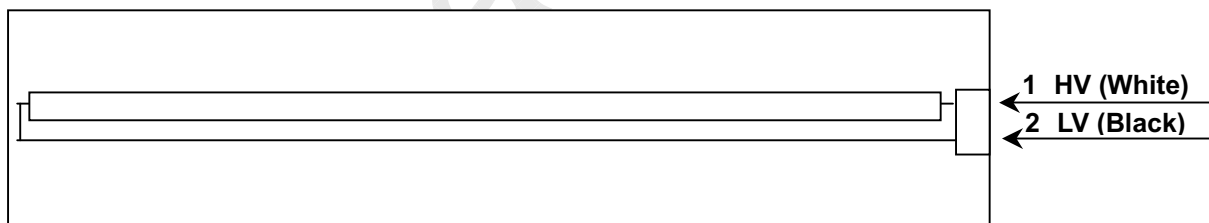
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V_{EDID}	DDC 3.3V Power		DDC 3.3V Power
5	NC	Non-Connection		
6	CLK_{EDID}	DDC Clock		DDC Clock
7	$DATA_{EDID}$	DDC Data		DDC Data
8	Rxin0-	LVDS Differential Data Input	Negative	R0~R5,G0
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	G1~G5, B0, B1
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	B2~B5, DE, Hsync, Vsync
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		
17	CLK-	LVDS Clock Data Input	Negative	LVDS Level Clock
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	Non-Connection		
21	NC	Non-Connection		
22	Vss	Ground		
23	NC	Non-Connection		
24	NC	Non-Connection		
25	Vss	Ground		
26	NC	Non-Connection		
27	NC	Non-Connection		
28	Vss	Ground		
29	NC	Non-Connection		
30	NC	Non-Connection		

Note (1) Connector Part No.: HRS MDF76KBW-30S-1H(58) or equivalent

Note (2) User's connector Part No: JAE-FI-X30M or equivalent

Note (3) The first pixel is odd as shown in the following figure.

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative
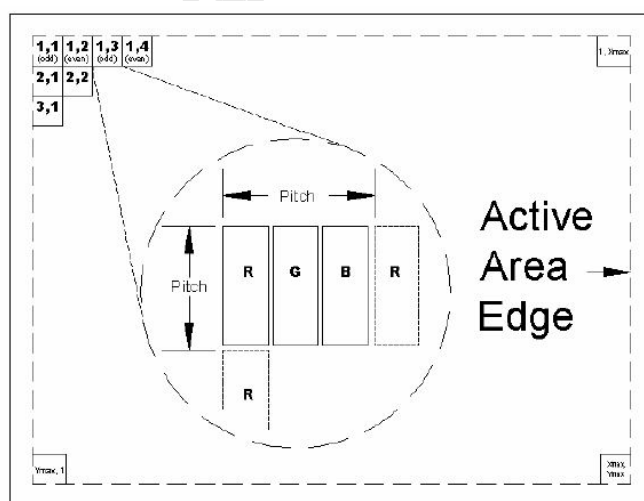
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	White
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative
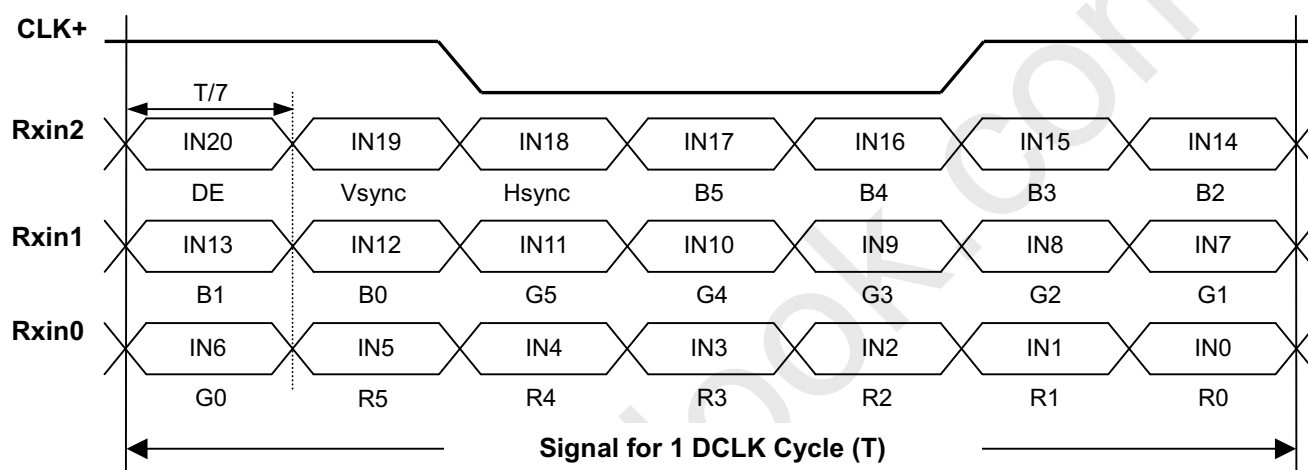
5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																		
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

CHI MEI
OPTOELECTRONICS CORP.

Tentative

5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the

VESA Plug & Display and FPDI standards.

Byte #(decimal)	Byte #(hex)	Field Name and Comments	Value(hex)	Value(binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N156B3-L01)	57	01010111
11	0B	ID product code (hex LSB first; N156B3-L01)	15	00010101
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed "00H")	28	00101000
17	11	Year of manufacture (fixed "00H")	11	00010001
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("35cm")	23	00100011
22	16	Max V image size ("19cm")	13	00010011
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	07	00000111
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	F5	11110101
27	1B	Red-x (Rx = "0.602")	9A	10011010
28	1C	Red-y (Ry = "0.340")	57	01010111
29	1D	Green-x (Gx = "0.306")	4E	01001110
30	1E	Green-y (Gy = "0.530")	87	10000111
31	1F	Blue-x (Bx = "0.151")	26	00100110
32	20	Blue-y (By = "0.120")	1E	00011110
33	21	White-x (Wx = "0.313")	50	01010000
34	22	White-y (Wy = "0.329")	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001

15 / 30

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("75.44MHz", According to VESA CVT Rev1.1)	78	01111000
55	37	# 1 Pixel clock (hex LSB first)	1D	00011101
56	38	# 1 H active ("1366")	56	01010110
57	39	# 1 H blank ("194")	C2	11000010
58	3A	# 1 H active : H blank ("1366 : 194")	50	01010000
59	3B	# 1 V active ("768")	00	00000000
60	3C	# 1 V blank ("38")	26	00100110
61	3D	# 1 V active : V blank ("768 :38")	30	00110000
62	3E	# 1 H sync offset ("59")	3B	00111011
63	3F	# 1 H sync pulse width ("39")	27	00100111
64	40	# 1 V sync offset : V sync pulse width ("5 : 10")	5A	01011010
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("59: 39 : 5 : 10")	00	00000000
66	42	# 1 H image size ("344 mm")	58	01011000
67	43	# 1 V image size ("193 mm")	C1	11000001
68	44	# 1 H image size : V image size ("344 : 193")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N156B3-L01", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name ("N")	4E	01001110
78	4E	# 2 2nd character of name ("1")	31	00110001
79	4F	# 2 3rd character of name ("5")	35	00110101
80	50	# 2 4th character of name ("6")	36	00110110
81	51	# 2 5th character of name ("B")	42	01000010
82	52	# 2 6th character of name ("3")	33	00110011
83	53	# 2 7th character of name ("-")	2D	00101101

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

84	54	# 2 8th character of name ("L")	4C	01001100
85	55	# 2 9th character of name ("0")	30	00110000
86	56	# 2 9th character of name ("1")	31	00110001
87	57	# 2 New line character indicates end of ASCII string	0A	00001010
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name"N154I3-L02", ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("1")	31	00110001
115	73	# 4 3rd character of name ("5")	35	00110101
116	74	# 4 4th character of name ("6")	36	00110110
117	75	# 4 5th character of name ("B")	42	01000010
118	76	# 4 6th character of name ("3")	33	00110011
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 9th character of name ("1")	31	00110001
123	7B	# 4 New line character indicates end of ASCII string	0A	00001010
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	56	01010110

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

## 6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	50	(76)	(85)	MHz	(2)
DE	Vertical Total Time	TV	(778)	(806)	(888)	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	(38)	TV-TVD	TH	
	Horizontal Total Time	TH	(1446)	(1560)	(1936)	Tc	(2)
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	(2)
	Horizontal Active Blanking Period	THB	TH-THD	(194)	TH-THD	Tc	(2)

INPUT SIGNAL TIMING DIAGRAM

Version 0.0

Tentative
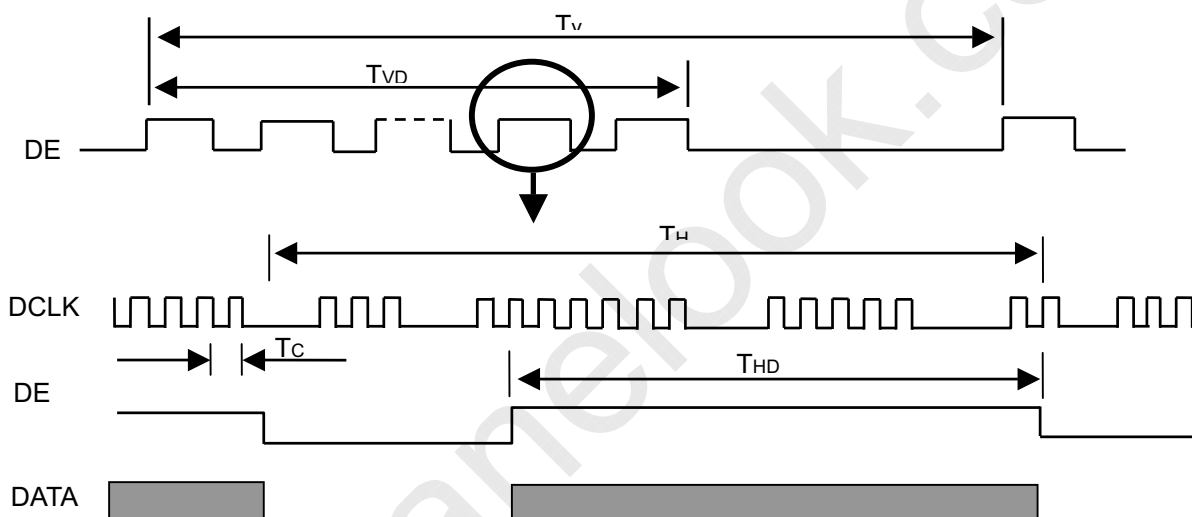
6.2 POWER ON/OFF SEQUENCE
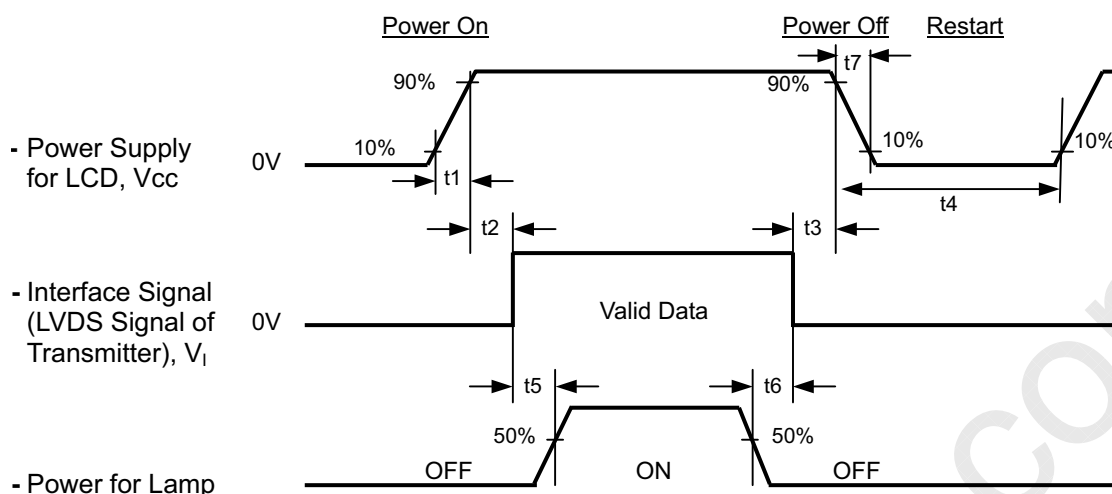
Timing Specifications:

　　　　0.5< t1 <= 10 msec

　　　　0 < t2 <= 50 msec

　　　　0 < t3 <= 50 msec

　　　　　t4 >= 500 msec

　　　　　t5 >= 200 msec

　　　　　t6 >= 200 msec

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow 5ms≦t7≦300 ms.

19 / 30

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	55	KHz
Inverter	Sumida-H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		350	500	-	-	(2), (5)
Response Time		T_R		-	3	8	ms	(3)
		T_F		-	7	12	ms	
Central Luminance of White		L_C		TBD	TBD		cd/m^2	(4), (6)
Average Luminance of White		L_{AVE}		200	220	-	cd/m^2	
Color Chromaticity	Red	Rx	$\theta_x=0°, \theta_Y=0°$ Viewing Normal Angle	TYP. -0.03	TBD	TYP. +0.03	-	(1)
		Ry			TBD		-	
	Green	Gx			TBD		-	
		Gy			TBD		-	
	Blue	Bx			TBD		-	
		By			TBD		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
	Color Gamut	C.G.		54	60		%	(7)
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45	-	Deg.	(1),(5)
		θ_x-		40	45	-		
	Vertical	θ_Y+		15	20	-		
		θ_Y-		40	45	-		
White Variation of 5 Points		δW_{5p}	$\theta_x=0°, \theta_Y=0°$ (BM-5A)	75	85	-	%	(5),(6)
White Variation of 13 Points		δW_{13p}		65	75-	-	%	

Version 0.0

Note (1) Definition of Viewing Angle (θx, θy):

Normal

θx = θy = 0º

θy- θy+

θX- = 90º   x-

12 o'clock direction

θy+ = 90º

y+

θx−

θx+

6 o'clock

y-

x+ θX+ = 90º

θy- = 90º
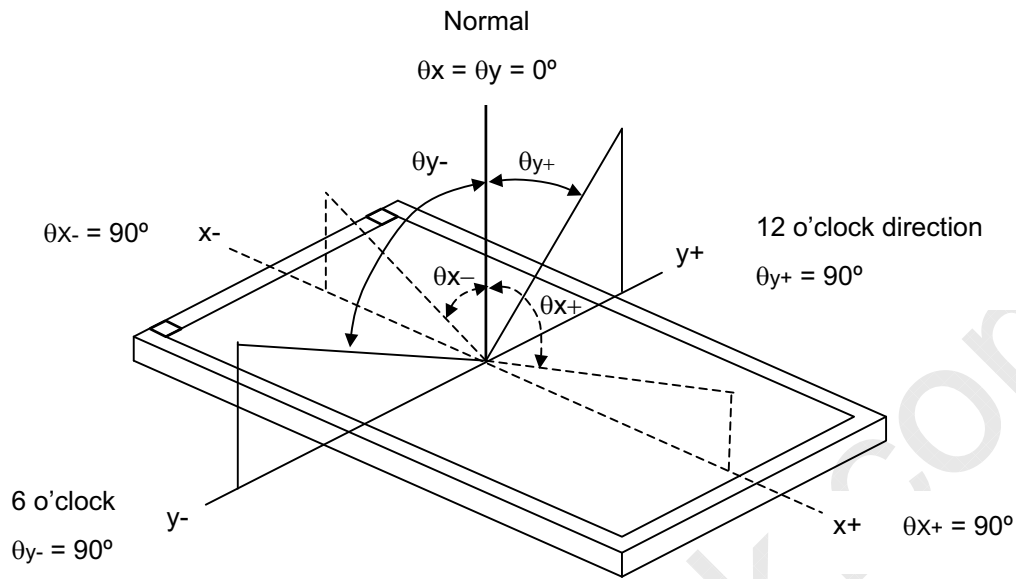
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.
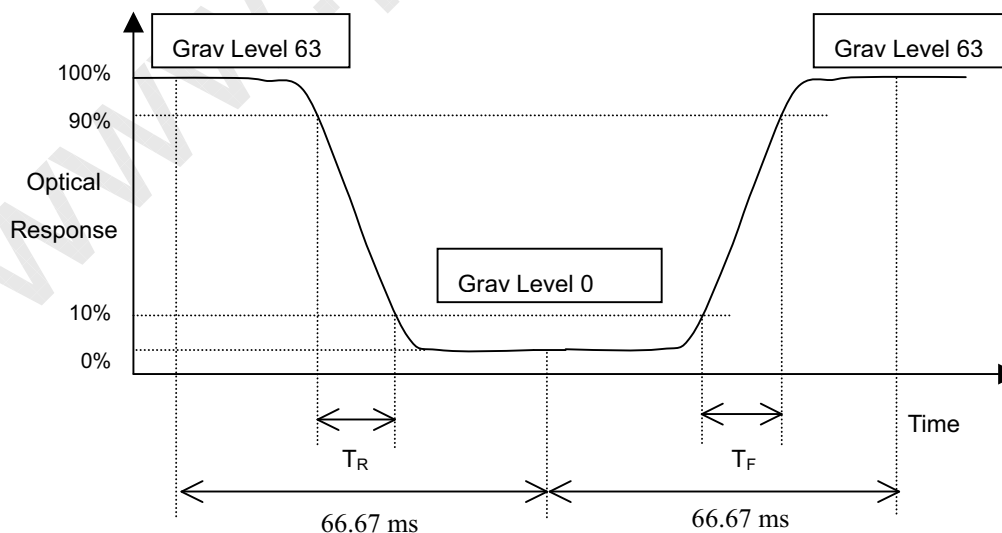
Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):

Grav Level 63   Grav Level 63

100%

90%

Optical

Response

Grav Level 0

10%

0%

Time

T_R T_F

66.67 ms   66.67 ms

21 / 30

Tentative

Note (4) Definition of Average Luminance of White (L_{AVE}):

    Measure the luminance of gray level 63 at 5 points

    $L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$

    L (x) is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

    The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

LCD Module

LCD Panel

Center of the Screen

Photometer
(CA210, CS-1000T)

Field of View = 2º

500 mm

Light Shield Room

(Ambient Luminance < 2 lux)

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative
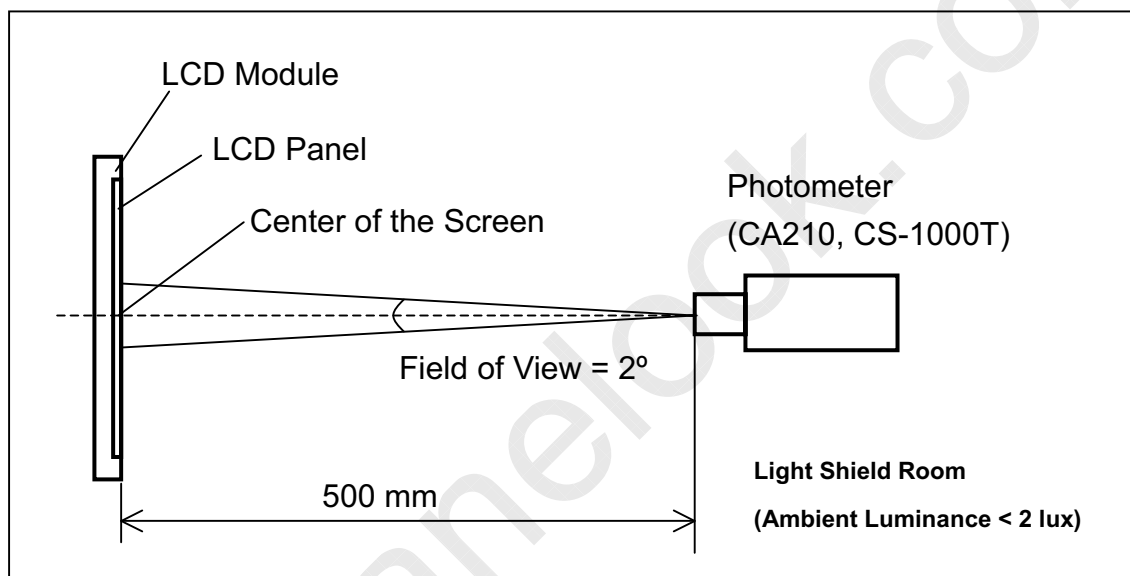
Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW_{5p} = Minimum [L (10)+ L (11)+ L (12)+ L (13)+ L (5)] / Maximum [L (10)+ L (11)+ L (12)+ L (13)+ L (5)]

δW_{13p} = Minimum [L (1) ~ L (13)] / Maximum [L (1) ~ L (13)]
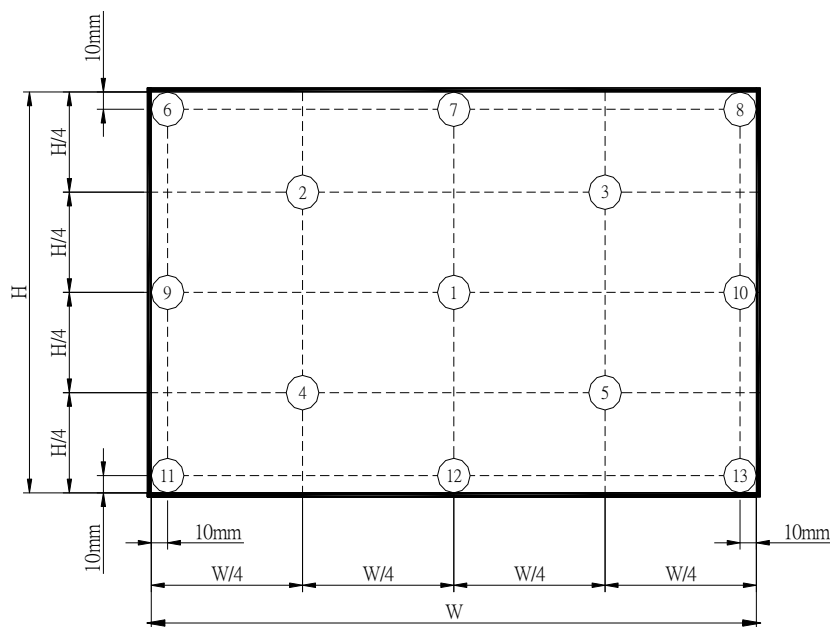
: Test Point

X=1 to 13
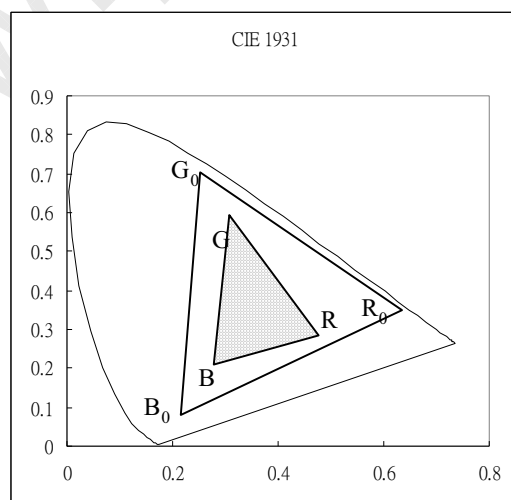
Active area

Note (7) Definition of color gamut (C.G%):

C.G%= R G B / $R_0 G_0 B_0$,*100%

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

• R G B: area of triangle defined by R, G, B

CIE 1931

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

Version 0.0

Tentative

9. PACKING

9.1 CARTON

Box Dimensions : 489(L)*382(W)*330(H)
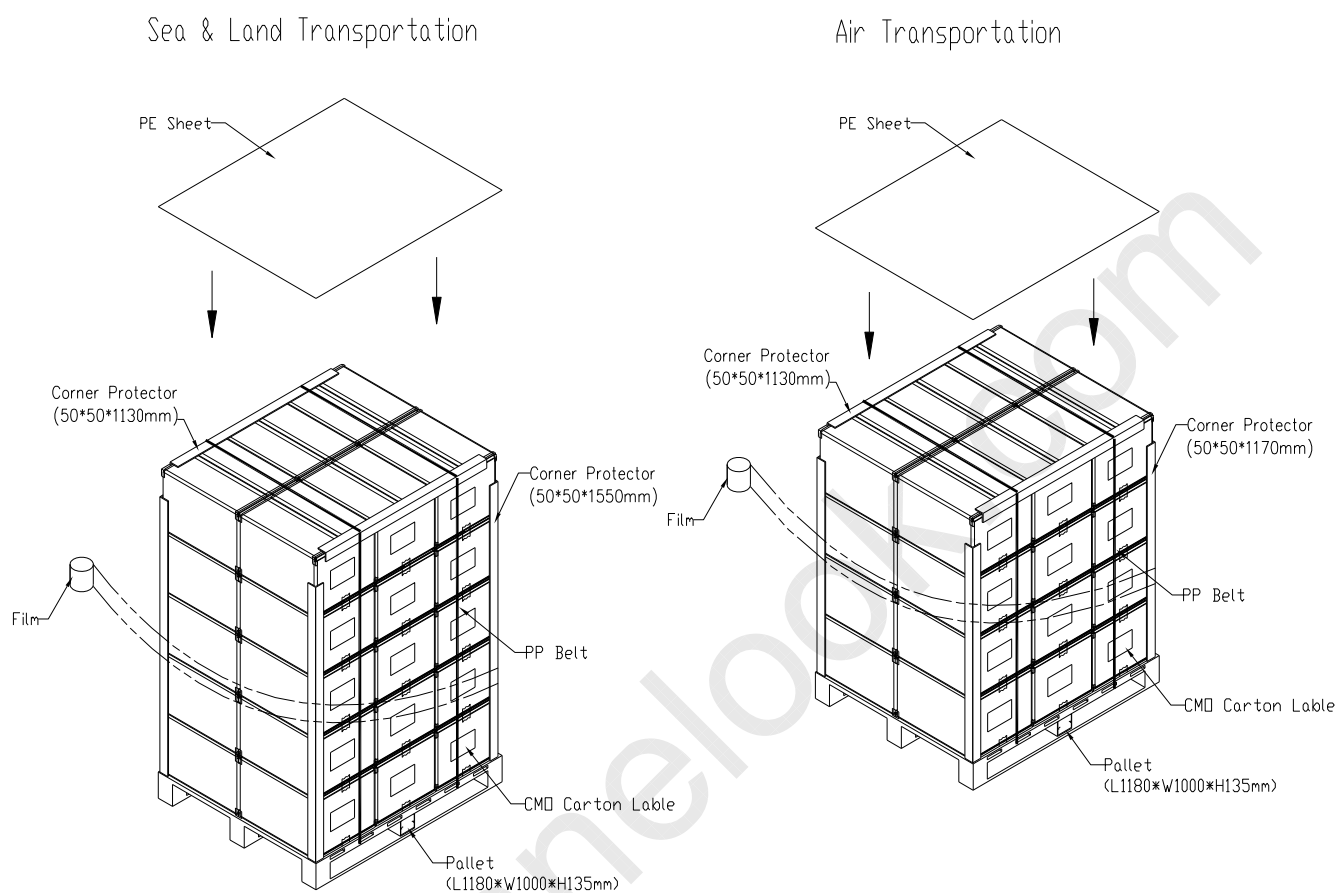Weight: Approx. 13.06kg(20 module .per. 1 box)
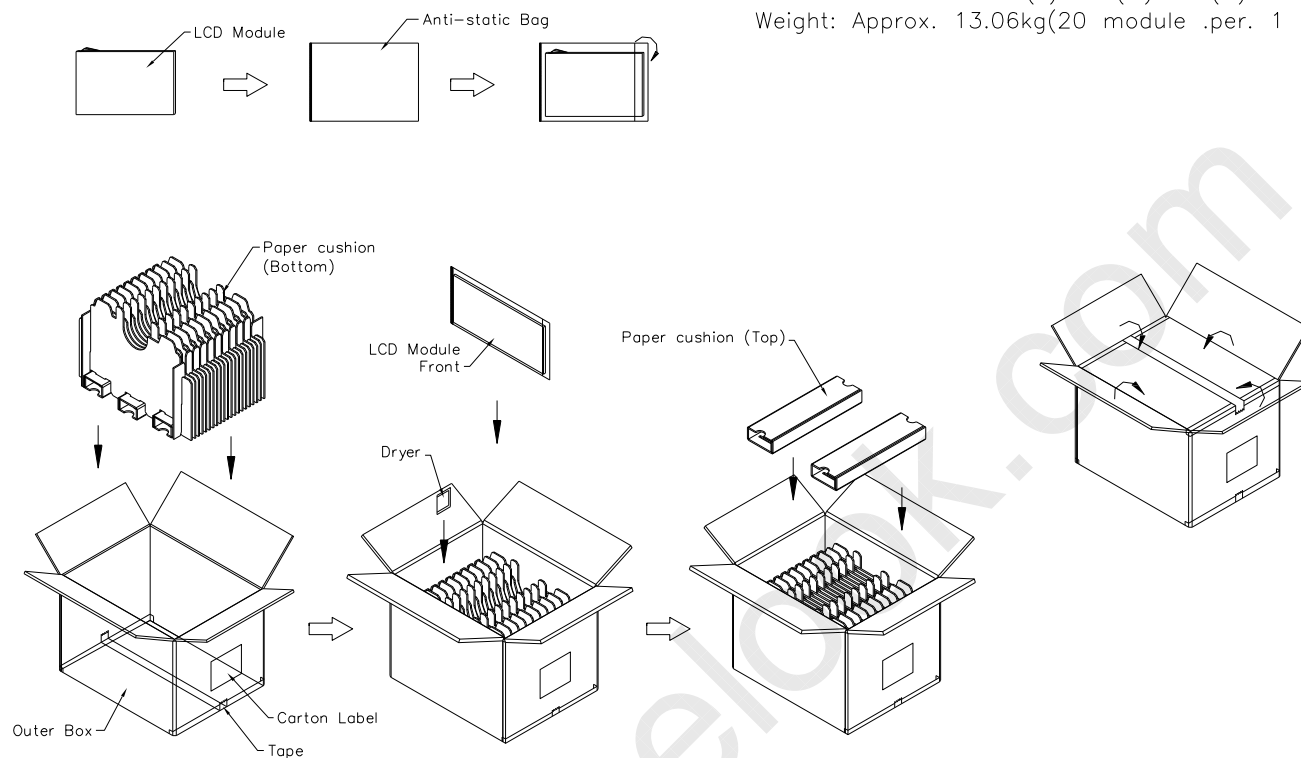
Figure. 9-1 Packing method

Version 0.0

Tentative

9.2 PALLET

Figure. 9-2 Packing method

Version 0.0

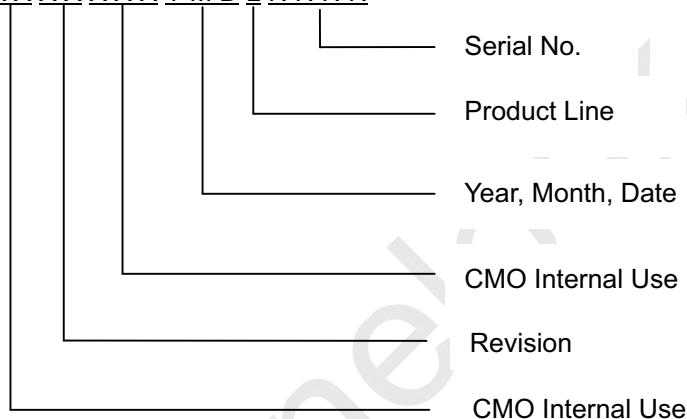**CHI MEI**
OPTOELECTRONICS CORP.

Tentative

10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

CHI MEI
OPTOELECTRONICS   N156B3 -L02   Rev. XX
E207943
.DE IN XXXX
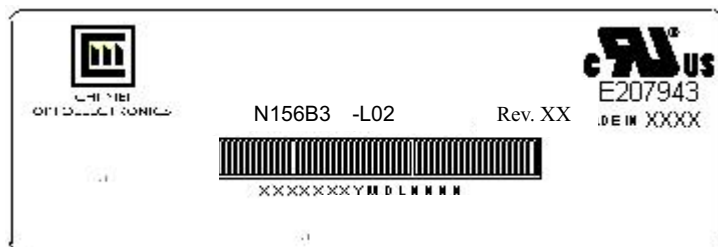
XXXXXXXXYMDLNNNN

(a) Model Name: N156B3 - L02

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D L N N N N

Serial No.

Product Line

Year, Month, Date

CMO Internal Use

Revision

CMO Internal Use

Serial ID includes the information as below **Figure. 9-3 Packing method**

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

Version 0.0

Doc No.:
Issued Date: Nov.14, 2007
Model No.: N156B3-L02 (TBD)

Tentative

10.2 CARTON LABEL

CHI MEI OPTOELECTRONICS

PO.NO. _____

Part ID. _____

Model Name _____

Carton ID. _____ Quantities _____

Made in XXXX   GP RoHS

Version 0.0